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Papier-, Umwelt- und Energietechnik

GOODMEN ENERGY

ETS2 Carbon Trading Explained:
Potential CO_2 costs and how to avoid them

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Authorized Signatory, Physicist, Head of Energy Concepts

- Transfer of **15 years of research experience** into planning practice
- Focus on multi-source systems, geothermal energy, solar thermal energy, large storage systems
- District heating systems "BEW/Heating Networks 4.0"
- References in the field of energy concepts, industrial analysis, district planning
- Office Manager Munich

"Everything begins with free thinking.

Followed by the possible."

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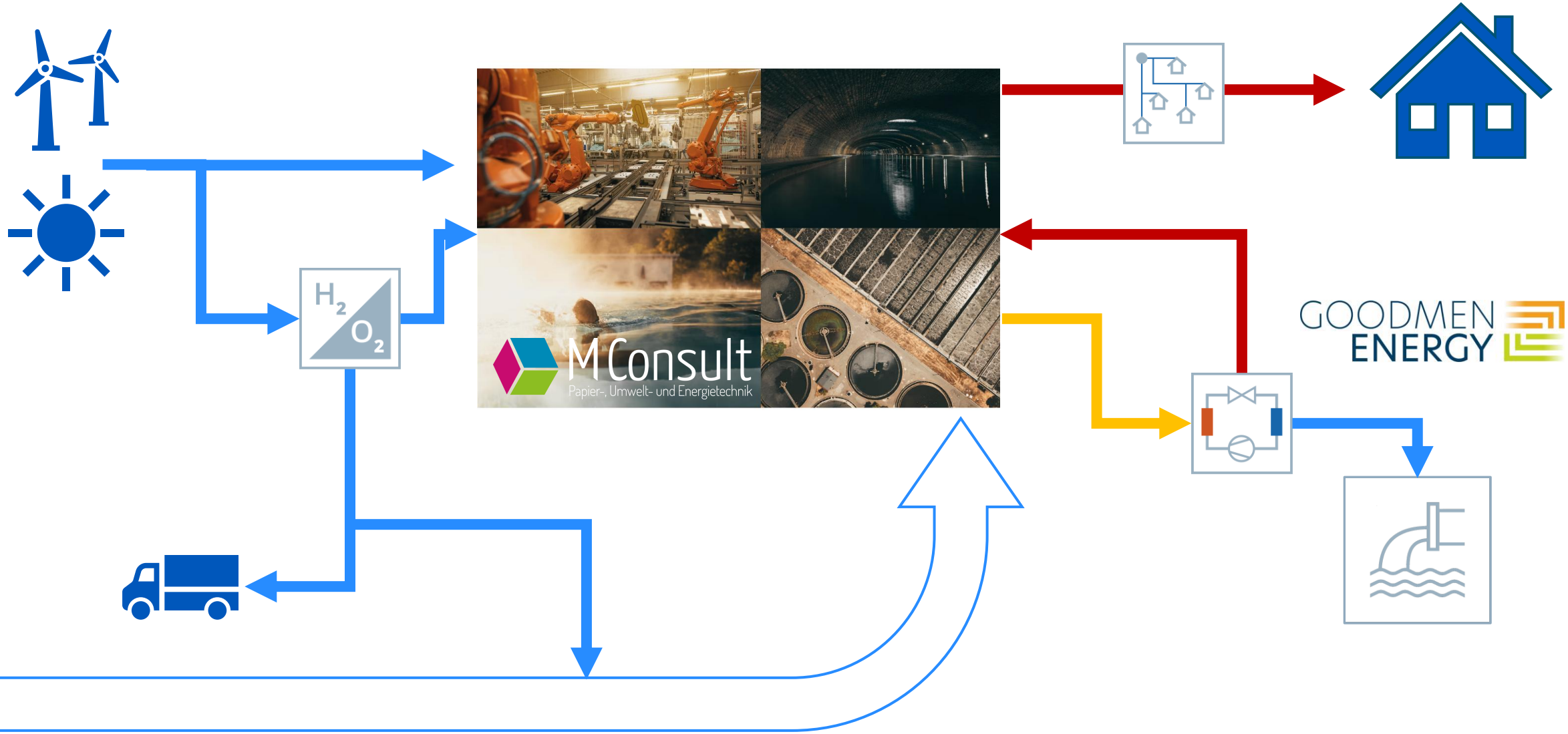
Partner for energy efficiency and sector coupling



Company Development

From start-up to a highly regarded thought leader

- Founded: 2020 as a start-up
- Current employees: 30
- Completed projects: > 180
- Projects in progress: 40

2021

2022

2025

What is ETS2?

- ETS2 is the new EU Emissions Trading System
- It complements the existing EU Emissions Trading System (ETS1)
- Objective: Reduce CO_2 emissions in sectors previously not covered
- Covered sectors now:
  - Road transport (petrol, diesel)
  - Buildings (heating with gas, oil, etc.)
- Start: from 2027 (maybe delay to 2028 depending on price of oil)
- Core idea: **Putting a price on CO_2** to encourage more climate-friendly behavior

How does ETS2 work?

- A **cap** is set on total CO_2 emissions
- Each ton of CO_2 requires an **emission allowance (certificate)**
- Companies (e.g., fuel suppliers) must buy these allowances
- The number of allowances decreases each year → **emissions go down**

Impact:

Fossil fuels become more expensive

Incentives for:

- Energy savings
- Renewable energy
- More efficient technologies

ETS1 vs ETS2 impact on Paper Industry

ETS2 mainly adds costs passed-through on transport fuels and non-ETS buildings or small sites

Dimension	ETS1 (existing EU ETS)	ETS2 (new separate system)	What it means for a paper company
Covered emissions	Power, heavy industry and maritime; paper mills with ETS-covered stationary combustion are in scope.	Buildings, road transport and additional sectors, mainly small industry not already in ETS1.	Large pulp & paper sites usually face ETS1 on core production; ETS2 mainly hits logistics, fleet fuel and non-ETS buildings.
Point of obligation	Installation operator surrenders allowances.	Fuel supplier surrenders allowances upstream.	ETS1 is a direct compliance cost; ETS2 is usually passed through in fuel invoices.
Allowance allocation	Mix of auctioning and free allocation for carbon-leakage sectors; indirect electricity cost aid may exist in some Member States.	All allowances auctioned.	ETS1 can be partially cushioned by free allocation; ETS2 has no free allocation for road/building fuels.

ETS1 vs ETS2 impact on Paper Industry

ETS2 mainly adds costs passed-through on transport fuels and non-ETS buildings or small sites

Dimension	ETS1 (existing EU ETS)	ETS2 (new separate system)	What it means for a paper company
Near-term price behavior	Fully market-driven carbon price.	Smooth-start rules: extra auctions in 2027, reserve can release allowances above €45 (2020 prices) in early years; start can slip to 2028 if 2026 gas/oil prices are exceptionally high.	ETS2 should start less abruptly than ETS1, but the pass-through still rises as fossil fuels remain in use.
Typical cost drivers in paper	Fossil CHP/boilers, lime kilns, site combustion, plus electricity-price pass-through from the power market.	Truck diesel, sales fleets, contractors' road fuel, and gas/oil in warehouses/offices or small non-ETS sites.	ETS1 is usually the bigger direct P&L issue; ETS2 broadens carbon cost into the supply chain.
Best responses	Fuel switch, electrification, heat recovery, biomass/biogas where sustainable, benchmark efficiency, power procurement strategy.	Transport efficiency, modal shift, EVs/biofuels, warehouse retrofits, non-fossil heating.	Decarbonise core heat first for ETS1; then tackle logistics and small-site fuels for ETS2.

Reducing CO_2 emissions and CO_2 costs in Paper Industry

A practical playbook

1. Fiber & Raw Material Stage (Upstream)

Concrete measures

- Increase recycled fiber content
- Optimize logistics and sourcing distances
- Use certified sustainable forestry (higher carbon sinks)

Example:
A corrugated plant increasing recycled content from 80% → 95% can reduce upstream CO_2 footprint by ~10–20%

Reducing CO_2 emissions and CO_2 costs in Paper Industry

2. Pulping & Stock Preparation

Concrete measures

- Install high-efficiency pulpers (direct drive) and refiners
- Use variable frequency drives (VFDs) on motors
- Optimize reject handling and fiber recovery

Example: Refiner optimization alone can reduce electricity demand by 10–25 kWh/t, which at €150/MWh = €1.5–3.75/t cost saving

Reducing CO_2 emissions and CO_2 costs in Paper Industry

3. Paper Machine (Core Process)

Concrete measures

- Increase dryness before dryer section through shoe press technology (higher dryness after press)
- Steam and condensate system optimization
- Improve runnability/decrease breaks by Advanced process control (e.g. AI-based moisture control)

Example: Increasing dryness from 45% → 50% before drying can reduce steam demand by **~15–20%**

Reducing CO_2 emissions and CO_2 costs in Paper Industry

4. Heat Generation & Energy System (BIGGEST LEVER) This is where ETS1 + ETS2 costs hit hardest

Levers

- Replace fossil fuels e.g. natural gas → biomass (wood chips, residues) or Biogas
- Use waste heat
- Electrify heat where possible

Examples:

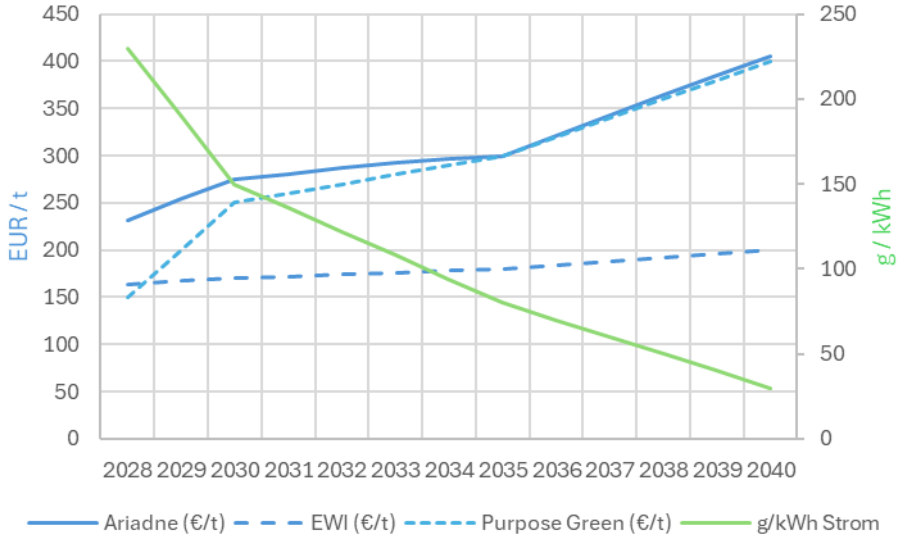
- Switching a 50 MW gas boiler: Gas emissions: ~0.2 t CO_2/MWh Annual: 300,000 MWh → 60,000 t CO_2 at €100/t → €6M/year ETS cost avoided
- A 10 MW heat pump replacing gas: Saves ~15,000 t CO_2/year at €100/t → €1.5M/year avoided carbon cost
- Selling excess heat to a district heating network → creates new revenue stream + improves CO_2 footprint

Opportunity costs ETS2 until 2040.

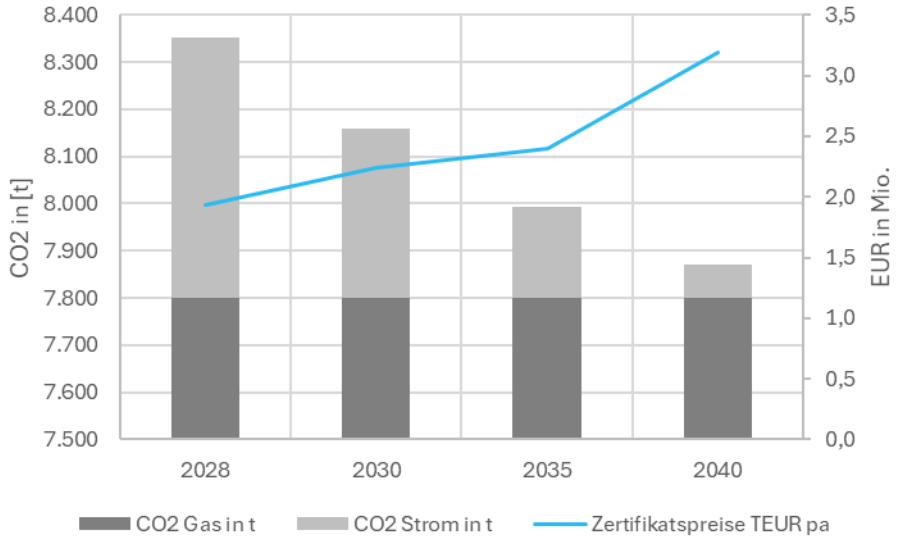
Real example from industry - based on current studies

Initial situation goodmen customer (example)

+ 30 GWh of natural gas
+ 7.4 GWh of electricity grid purchase
+ Ariadne Study Forecast CO_2 Price ETS2
+ Forecast CO_2 share of German electricity mix



Opportunity Cost



Cumulative CO_2 certificate costs until 2040:
EUR 32 million
according to Ariadne's study

ETS2 Online Tool

www.CO2weg.de

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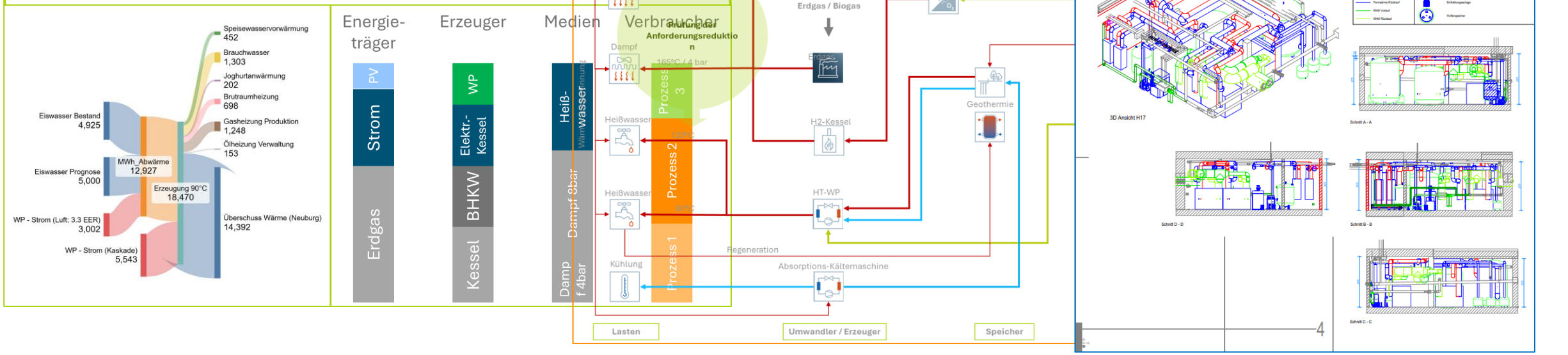
Planning the journey

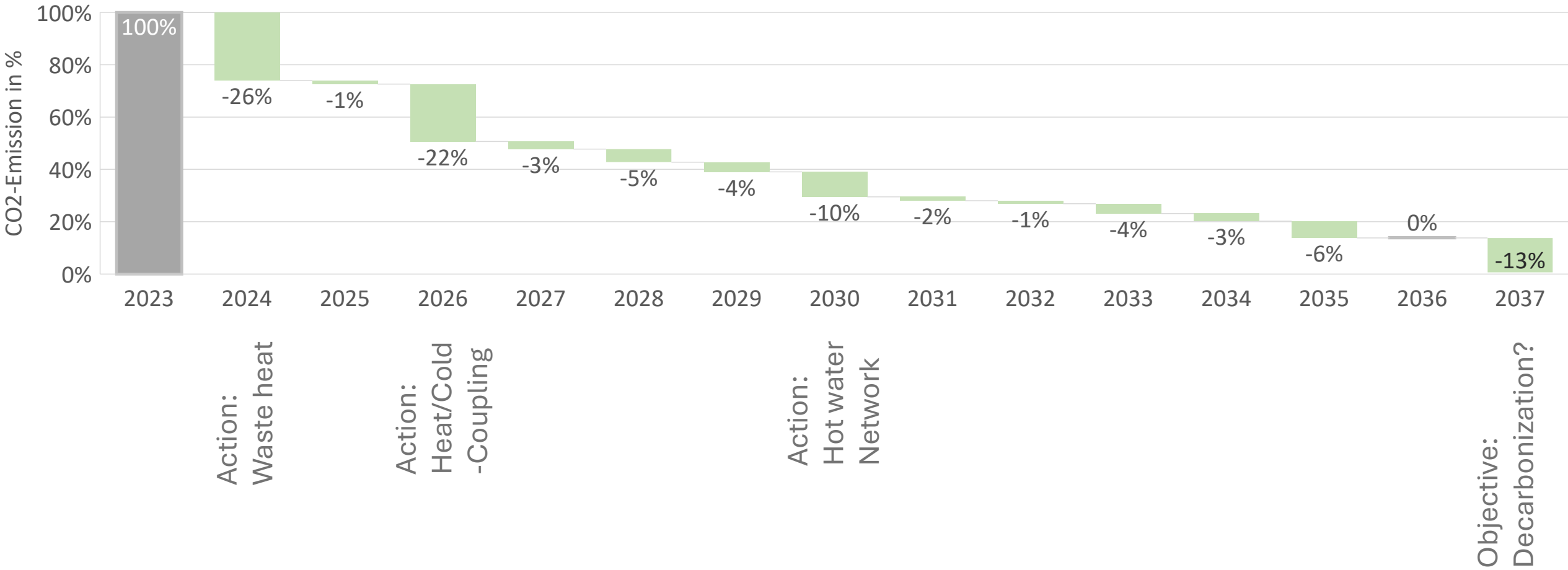
Transformation of energy supply

Demand Recording | Power analysis | Potentials +Concepts | Target scenario | Planning | Implemen-tation



Transformation path: CO_2 emissions

by calendar year



Measures

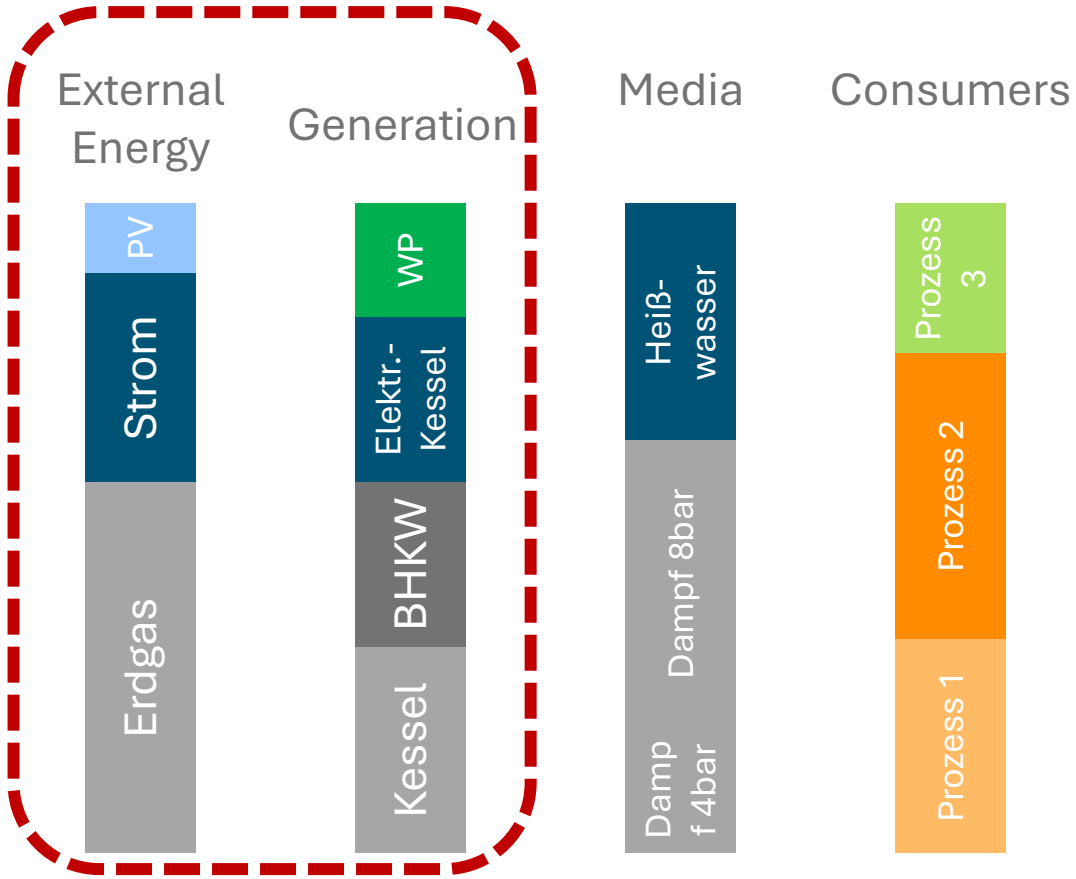
Overview "Solution Builder"

Alternative energy sources: Biogas/H2/Biomass	Efficiency: Heat recovery	Efficiency: Shifting loads	Lowering process temperatures (steam -> hot water)
Waste heat – heat pump	Coupling Heat and Cold Production (heat pump)	Use of high-temperature WP (sources)	Construction/participation/PPA Electricity CO2 free

Goal: Closed Presentation Heat

From generation to consumption

Display greatly simplified



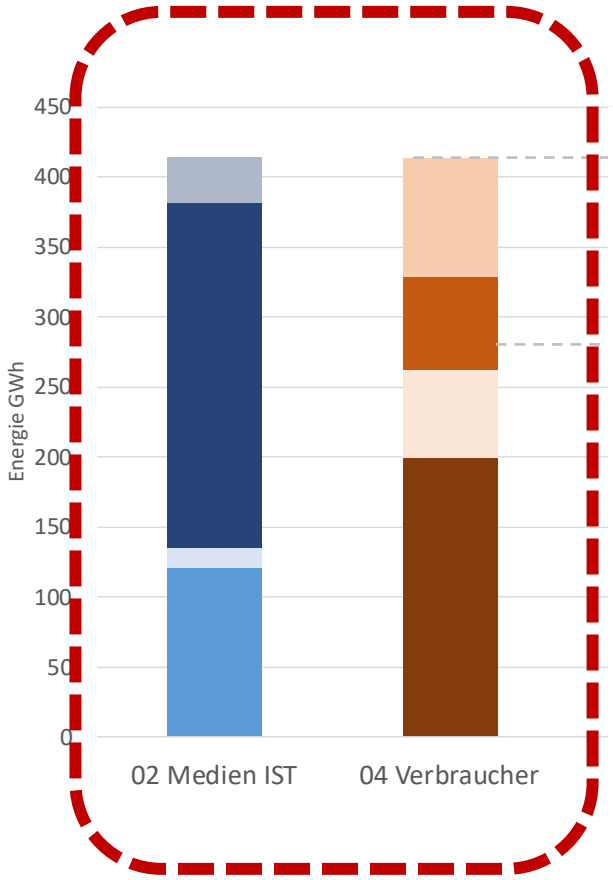
In order to assess the future viability of the energy supply at the site in terms of economic efficiency and political framework conditions, **a complete summary of the energy system** is expedient.

Listed in each case in heat quantity, power and temperature level.

Forecasts can then be made on the political and economic framework conditions of the future

Heat energy balance: use of waste heat

Waste heat utilization and supply gap in heat demand



Heat and Process cooling
Electronic industry

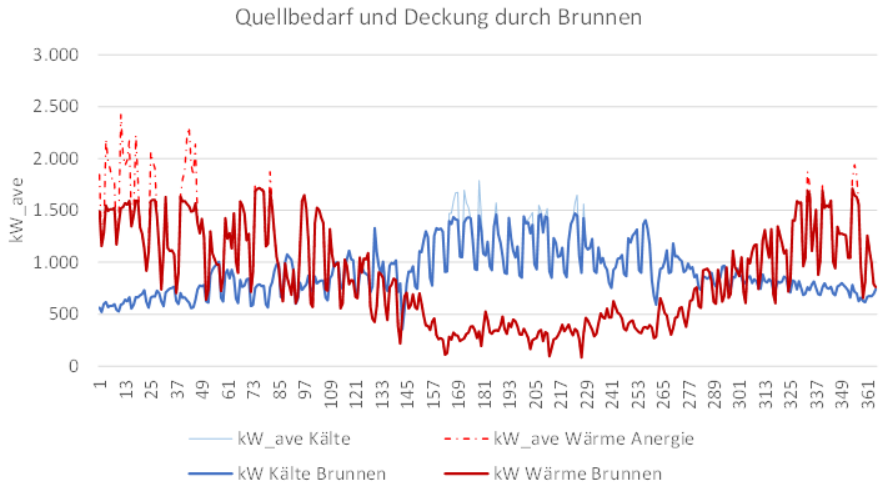
Microchip production – Munich city centre

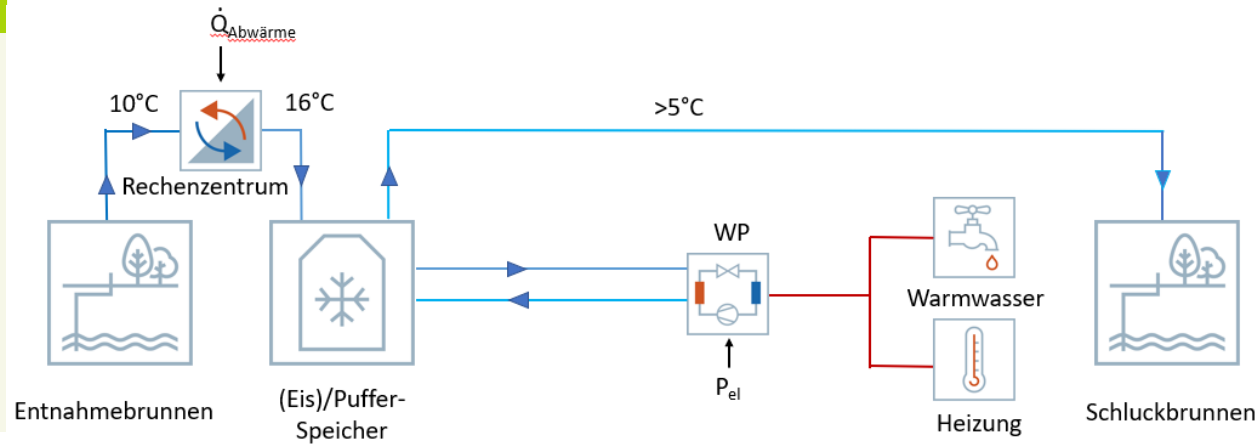
Application

- A new regenerative heating and cooling supply for the site: 10 buildings, 46,000m^2
- 10 GWh cooling, 9 GWh heating

Concept

- Simultaneous heating and cooling
- Coupling with groundwater well use





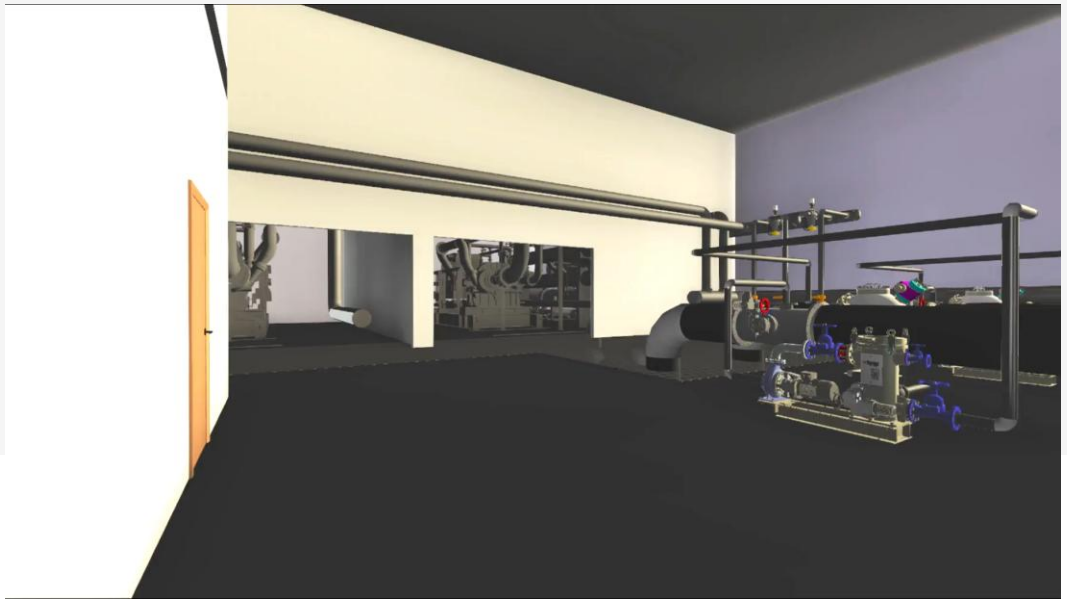
Process heat for industrial area

Project information:

- **2 x 10 MW heat pump at the sewage treatment plant**
- 1 x 10 MW waste wood use class A1 and A2
- 2 x 5 MW Power to Heat (1 x directly in the biomass boiler)
- Over 10 km of heating network

- **Connection to urban living area**

Concept:



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